

# Java™ magazine

By and for the Java community 

DECORATOR DESIGN PATTERN 67 | JAVA QUIZ 78

NOVEMBER/DECEMBER 2018

**LARGEST  
JAVA SURVEY  
EVER**  
RESULTS PAGE 15

## Java Present and Future

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IN JAVA 11

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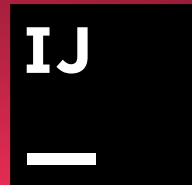
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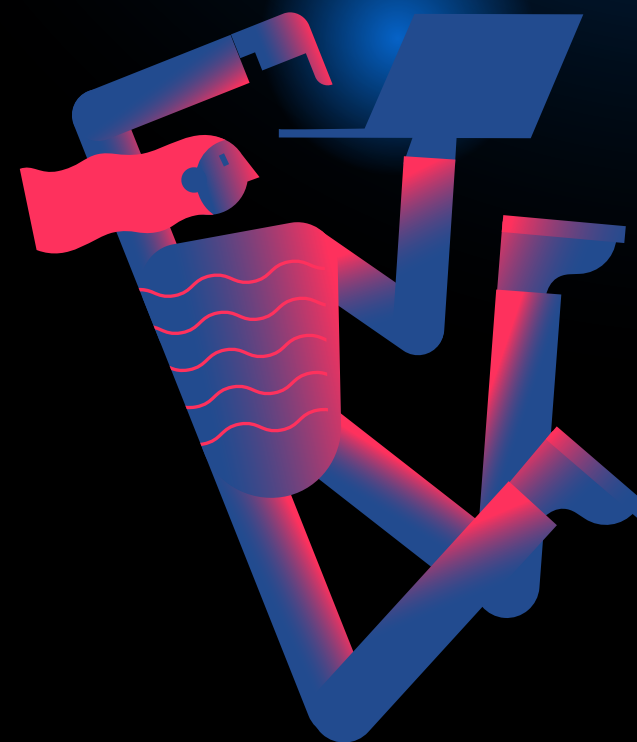


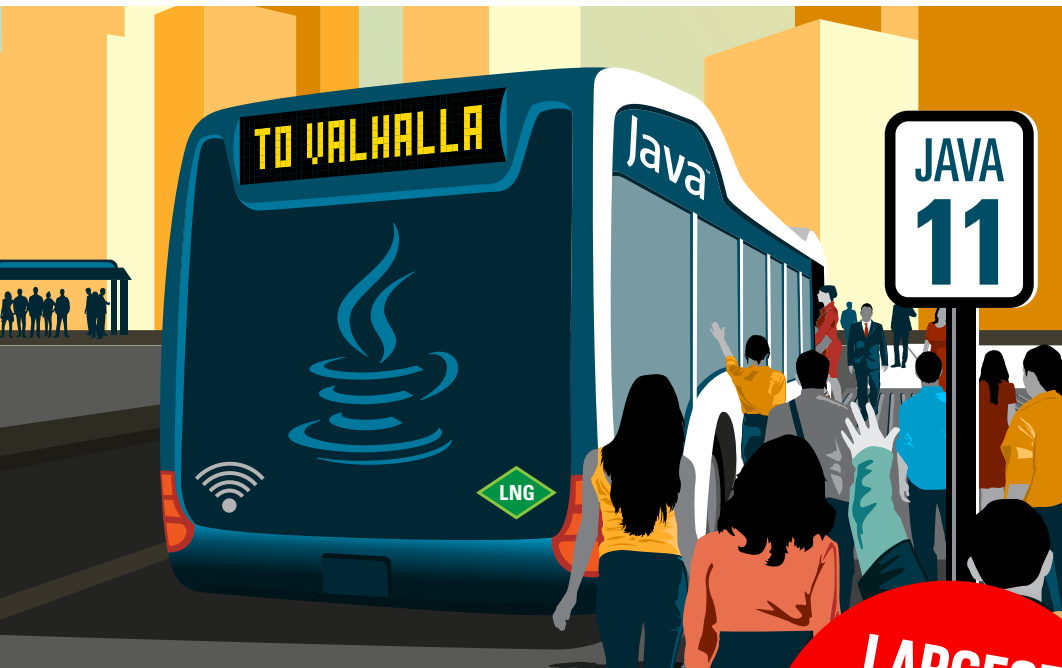
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By Simon Maple and Andrew Binstock  
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### Contact Us

Have a comment? Suggestion? Want to  
submit an article proposal? Here's how.







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SEPTEMBER/OCTOBER 2018

## Comments as Design Elements

I'm so totally on board with your suggestions in your editorial "Using Comments to Design Classes," in the September/October issue—particularly your example of using a comment to describe what you're planning to do. I've been pseudocoding since 1985, when I graduated from Troy State University. To everyone who is willing to listen here on my development team, I say "write it down in English." Listen to what you wrote and rewrite it, if necessary, before you write a line of code. You will be amazed how easy your software development life will become!

I just want to say thank you for your editorial piece. I am printing it now, and it is going up on my cube wall.

—Peter Pahules  
Scottsdale, Arizona

## Step-by-Step Guide for Using Jakarta EE

I built a step-by-step guide for implementing the project described by Josh Juneau in his article “Jakarta EE: Building Microservices with Java EE’s Successor,” in the September/October issue. I’ve made it available for your readers to access.

—Mikalai Zaikin  
Minsk, Belarus

*Editor Andrew Binstock responds: This excellent tutorial contains a step-by-step setup of the IDE, the server, and finally of the implementation of the project, complete with numerous screenshots and hands-on tips. The guide is available in the Java Magazine [download area](#) or directly as a PDF file [here](#). Zaikin is a coauthor of the “Fix This” quiz column that appears in every issue.*

## Covering Containers—and More

There is so much happening with Java these days that it's a relief to get the straight dope from *Java Magazine*. However, one topic I'd like to see more coverage of is developing container-based applications. Can you wrangle some content about that?

—Will Rubin  
Bend, Oregon

*Editor Andrew Binstock responds: Thanks for the kind words. We are indeed planning coverage of containers. In fact, here are the topics scheduled for 2019:*

- *January/February: Lightweight frameworks*
- *March/April: Big data*
- *May/June: Containers (and coverage of Java 12)*
- *July/August: Libraries (our annual issue)*
- *September/October: Java 13 and a preview of Java 14*
- *November/December: Testing*

*As always, editorial calendars are subject to change.*

## Corrigenda

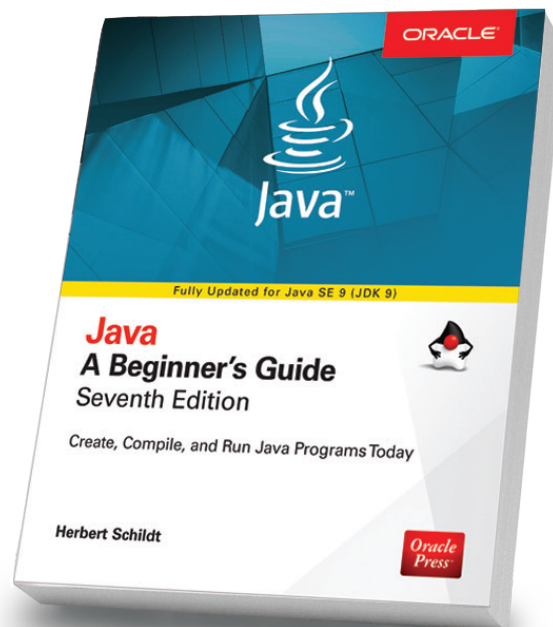
In the September/October 2018 issue, we were less than clear about where the unpublished listings are located for Josh Juneau’s article “Jakarta EE: Building Microservices with Java EE’s Successor.” They are located [here](#). Note a small update to one of the files has been made since publication of the article.

## Contact Us

We welcome comments, suggestions, grumbles, kudos, article proposals, and chocolate chip cookies. All but the last two might be edited for publication. If your note is private, please indicate this in your message. Write to us at [javamag\\_us@oracle.com](mailto:javamag_us@oracle.com). For other ways to reach us, see the last page of this issue.



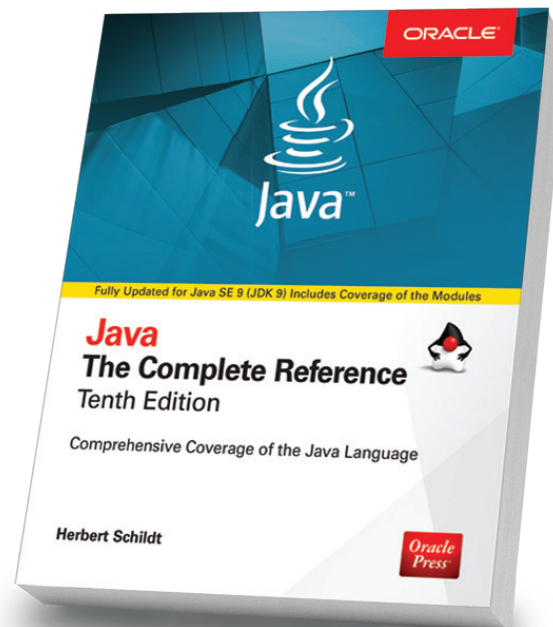
Written by leading experts in Java, Oracle Press books offer the most definitive, complete, and up-to-date coverage of Java available.



## Java: A Beginner's Guide, 7th Edition

*Herb Schildt*

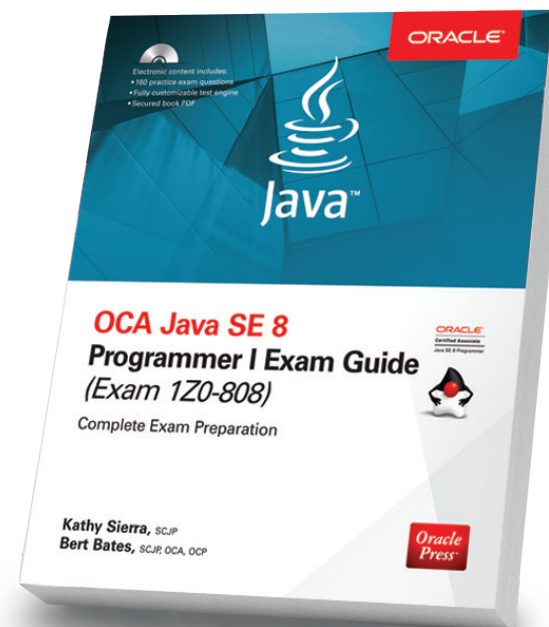
Revised to cover Java SE 9, this book gets you started programming in Java right away. Free online supplement covering key new features in JDK 10 available for download on the book's page on OraclePressBooks.com



## Java: The Complete Reference, 10th Edition

*Herb Schildt*

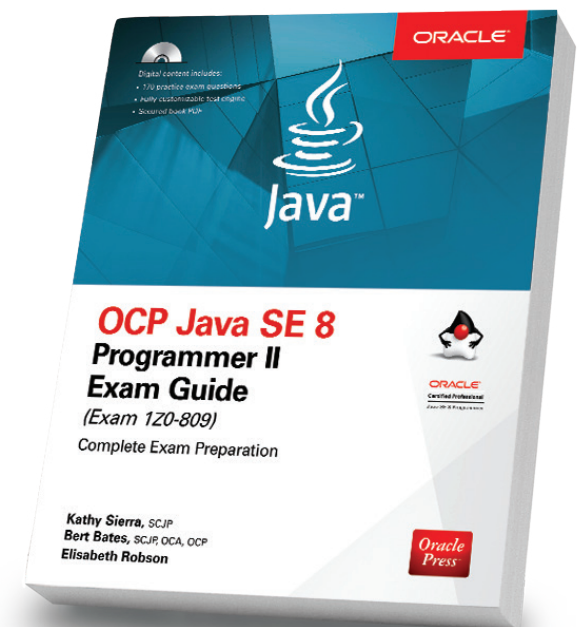
Updated for Java SE 9, this book shows how to develop, compile, debug, and run Java programs. Visit the book's page on OraclePressBooks.com to download free supplements on JDK's key new features.



## OCA Java SE 8 Programmer I Exam Guide (Exam 1Z0-808)

*Kathy Sierra, Bert Bates*

Get complete coverage of all objectives for Exam 1Z0-808. Electronic practice exams include more than 200 questions that help you prepare for this challenging test.



## OCP Java SE 8 Programmer II Exam Guide (Exam 1Z0-809)

*Kathy Sierra, Bert Bates, Elisabeth Robson*

Prepare for the OCP Exam 1Z0-809 with this comprehensive guide which offers every subject appearing on the exam. Includes more than 350 practice questions.







## **CodeMash 2019**

JANUARY 8–11, 2019

SANDUSKY, OHIO

CodeMash is an event that educates developers on current practices, methodologies, and technology trends in a variety of platforms and development languages including Java, .NET, Ruby, Python, and PHP. The Java track features presentations from many Java Champions.

## **Codemotion Berlin**

NOVEMBER 20–21

BERLIN, GERMANY

Codemotion conferences are devoted to developers sharing the latest tech information and best practices among the tech community worldwide. Confirmed speakers at this event include Picnic CTO Daniel Gebler, Apache Software Foundation member Kanchana Welagedara, and Microsoft Senior Program Manager Christian Heilmann. The event is open to all languages and technologies and features coding lectures and workshops.

## **Topconf Tallinn 2018**

NOVEMBER 20–22

TALLINN, ESTONIA

Topconf Tallinn is an international software conference covering Java, open source, agile development, architecture, and new languages.

## **Voxxed Days Cluj-Napoca**

NOVEMBER 21–22

CLUJ-NAPOCA, ROMANIA

This conference brings together well-known speakers, core developers of popular open source technologies, and professionals willing to share their knowledge

and experience. Scheduled speakers include Agile expert Venkat Subramaniam and Java Champion Vlad Mihalcea.

## **JVM-Con**

NOVEMBER 27–28

COLOGNE, GERMANY

Among the topics slated for this German conference devoted to JVM languages are the JRE, concurrency, Java EE, mobile, and cloud-native development. (Website in German.)

## **Codemotion Milan**

NOVEMBER 29–30

MILAN, ITALY

Codemotion conferences are devoted to developers sharing the latest tech information and best practices among the tech community worldwide. Confirmed speakers at this event include Rogue Wave Senior Software Engineer Enrico Zimuel, ThoughtWorks Quality Analyst Wamika Singh, and Accenture Manager Maurizio Mangione. The event is open to all languages and technologies and features coding lectures and workshops.



**Clojure/conj 2018**

NOVEMBER 29–DECEMBER 1  
DURHAM, NORTH CAROLINA

This event is expected to draw more than 400 Clojure developers from around the world for three days of cutting-edge Clojure, ClojureScript, and functional programming talks.

**DevTernity**

NOVEMBER 30–DECEMBER 1  
RIGA, LATVIA

The DevTernity forum covers the latest developments in coding, architecture, operations, security, leadership, and many other IT topics. Venkat Subramaniam, author of *Programming Concurrency on the JVM* and *Functional*

*Programming in Java*, is slated to be one of the featured speakers.

**The Lead Developer Austin**

DECEMBER 6  
AUSTIN, TEXAS

This conference for tech leads, engineering managers, and CTOs promises a day of inspiring talks and practical takeaways to help you become a better team leader. Topics planned for discussion include refactoring, code review, and GraphQL.

**ArchConf 2018**

DECEMBER 10–13  
CLEARWATER, FLORIDA

ArchConf is an educational event for software architects, techni-

cal leaders, and senior developers presented by the No Fluff Just Stuff software symposium. Among scheduled sessions are talks on applying design patterns, building serverless applications, machine learning, and scalable microservices.

**KubeCon + CloudNativeCon**

DECEMBER 10, COMMUNITY EVENTS  
AND LIGHTNING TALKS  
DECEMBER 11–13, CONFERENCE  
SEATTLE, WASHINGTON

The Cloud Native Computing Foundation's flagship North American conference gathers adopters and technologists from leading open source and cloud native communities to further the education and advancement of cloud native computing.

**EmTech Asia**

JANUARY 22–23, 2019  
SINGAPORE

EmTech Asia is an international conference hosted in collaboration with *MIT Technology Review*. Talks and presentations focus on emerging technologies.

**SnowCamp 2019**

JANUARY 23, 2019, WORKSHOPS  
JANUARY 24–25, 2019, CONFERENCE  
JANUARY 26, 2019, UNCONFERENCE  
GRENOBLE, FRANCE

SnowCamp is a developer conference held in the French Alps that focuses on innovation, exchange, and research exploring web, cloud, DevOps, and software architecture topics. The event features a mix of sessions in French and English. The last day, dubbed “unconference,” offers a unique opportunity to socialize with peers and speakers on the ski slopes.

**DevConf.cz**

JANUARY 25–27, 2019  
BRNO, CZECH REPUBLIC

DevConf.cz is an open source developer and DevOps conference. There is no admission or ticket charge for DevConf.cz events, but free registration is required. All talks, presentations, and workshops will be conducted in English. Topics under consideration this year include blockchain, middleware, machine learning, and immutable operating systems.





### jSpirit

JANUARY 25–27, 2019

HAUSHAM, GERMANY

jSpirit is a new community-organized, nonprofit Java “unconference” in the Bavarian Alps featuring two days of sessions at the Lantenhammer Erlebnisdestillerie Hausham followed by two days of skiing. A mini-conference for kids, jSpirit4Kids, is slated for January 28.

### Domain-Driven Design Europe

JANUARY 28–30, 2019, WORKSHOPS

JANUARY 31–FEBRUARY 1, 2019, CONFERENCE

AMSTERDAM, THE NETHERLANDS

This software development and engineering event spans analy-

sis, modeling and design, systems thinking and complexity theory, architecture, testing and refactoring, visualization, and collaboration.

### O'Reilly Software Architecture Conference

FEBRUARY 3–4, 2019, TRAINING

FEBRUARY 4–6, 2019, TUTORIALS AND CONFERENCE

NEW YORK, NEW YORK

This event consists of four days of in-depth professional software architecture training on topics ranging from domain-driven design and event-driven microservices to database architecture.

### Jfokus

FEBRUARY 4–6, 2019

STOCKHOLM, SWEDEN

Sweden's largest developer conference will cover Java and JVM languages, as well as best practices and emerging technologies. On February 4, the conference will hold the Jfokus VM Tech Summit, which is an open technical collaboration among language designers, compiler writers, tool builders, runtime engineers, and VM architects.

### JSConf Hawaii

FEBRUARY 7–8, 2019

HONOLULU, HAWAII

The inaugural Hawaiian JSConf for JavaScript developers promises a fun and welcoming gathering where diversity thrives and attendees can discuss JavaScript as a technology and grow it as a community.

### DeveloperWeek SF Bay Area

FEBRUARY 20–24, 2019

OAKLAND, CALIFORNIA

The DeveloperWeek expo and conference series gathers 8,000 participants for a weeklong, technology-neutral programming conference and associated

area events. Tracks include artificial intelligence, blockchain development, popular programming languages, microservices, and mobile.

### AgentConf 2019

FEBRUARY 21–24, 2019

DORNBIRN AND LECH, AUSTRIA

AgentConf is an international event that combines software development and skiing and features talks by world-class engineers envisioning the future of mobile and web technologies. Speaker sessions are hosted in Dornbirn; skiing and networking take place in Lech.

### Embedded World 2019

FEBRUARY 26–28, 2019

NUREMBERG, GERMANY

Now celebrating its 17th year, this annual embedded systems developer event will focus on the state of embedded intelligence, which is shaping systems ranging from autonomous vehicles to image recognition and embedded vision systems to preventive and demand-driven maintenance in small edge computers as well as high-performance cloud servers.

```
//events/
```

## QCon London

MARCH 4–6, 2019, CONFERENCE

MARCH 7–8, 2019, WORKSHOPS

*LONDON, ENGLAND*

Although the content has not yet been announced, past QCon conferences have offered several Java tracks along with tracks related to web development, DevOps, cloud computing, and more.

Proposed session topics include machine learning, software ethics, and DSLs.

# Devnexus

MARCH 6-8, 2019

ATLANTA, GEORGIA

Devnexus is an international open source developer conference. Its stated goal is to connect developers from all over the world, provide affordable education, and promote open source values. Past presenters have included Java experts Donald Raab and Venkat Subramaniam.

# ConFoo Montreal

MARCH 13–15, 2019

MONTREAL, CANADA

This multitechnology conference for web developers promises 155 presentations and typically features sessions tailored for Java and JVM developers.

## JavaLand 2019

MARCH 19–21, 2019

BRÜHL, GERMANY

This annual conference features lectures on subjects such as core Java and JVM languages, micro-services architecture, front-end development, and much more.

## Voxxed Days Zürich

MARCH, 2019 (DATES NOT FINALIZED)

ZÜRICH, SWITZERLAND

Voxxed Days Zürich shares the Devovx philosophy that content comes first and draws internationally renowned and local speakers discussing topics such as cloud development, containers, machine learning, and programming languages. The schedule of speakers had not yet been announced at press time.

Are you hosting an upcoming Java conference that you would like to see included in this calendar? Please send us a link and a description of your event at least 90 days in advance at [javamag\\_us@oracle.com](mailto:javamag_us@oracle.com). Other ways to reach us appear on the last page of this issue.

```
//user groups/
```

# CENTRAL OHIO JUG



The Central Ohio Java Users Group, [COJUG](#), was founded in 1997 and has been going strong ever since. Hosted in Columbus, Ohio, COJUG holds two meetings the second Tuesday of every month—one during the lunch hour and one in the evening. These meetings usually present the same

speaker and content, but offering two meeting times helps to accommodate attendees' schedules. This format has also enabled the group to more than double regular attendance, averaging more than 70 attendees each month from a mailing list of more than 650 members.

Eleven years ago, COJUG, along with several other local user groups including the .NET user group, started a conference called CodeMash that combined the different technology interests and communities. The conference is held each January in Sandusky, Ohio. Northern Ohio in January might seem like a strange location and time, but holding the conference at the Kalahari indoor water park with an associated free kids' conference called KidzMash makes this a warm and family-friendly experience. The four-day event attracts more than 2,200 developers and architects. Over the years, CodeMash has hosted many Java Champions and regional JUG leaders as presenters. The next event takes place January 8 to 11, 2019.

If you are interested in getting involved in COJUG as an attendee, speaker, or sponsor, please visit the COJUG [website](http://cojug.org) or email the user group at [cojug@cojug.org](mailto:cojug@cojug.org) for details.



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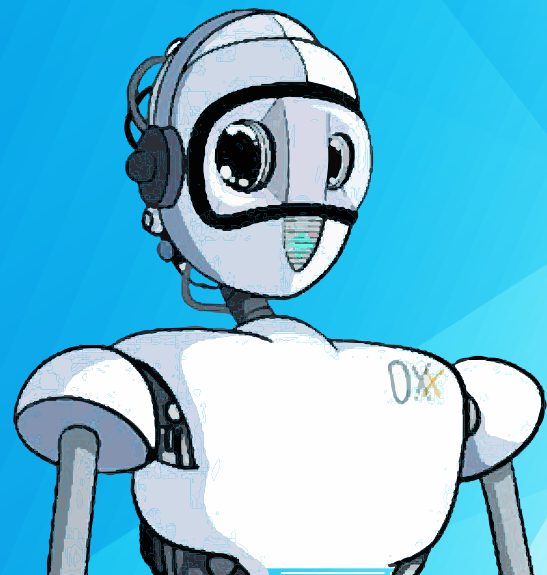
**UK 8-10 MAY**

**POLAND 24-27 JUNE**

**UKRAINE DATE TBA**

**BELGIUM DATE TBA**

**MOROCCO DATE TBA**



**BUCHAREST 20-22 MARCH**

**ZURICH 21 MARCH**

**MILAN 13 APRIL**

**CERN 1 MAY**

**MELBOURNE 14 MAY**

**FRONTEND, BUCHAREST 22 MAY**

**MINSK 24-25 MAY**

**SINGAPORE 30-31 MAY**

**ATHENS 31 MAY-1 JUNE**

**LUXEMBOURG DATE TBA**

**TICINO DATE TBA**

**MICROSERVICES, PARIS DATE TBA**

**THESSALONIKI DATE TBA**

**CLUJ-NAPOCA DATE TBA**

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## JAVA LICENSING EXPLAINED 52

Finally, the product management team for Java explains recent changes ([page 52](#)) to the licensing model. In addition, we have a deep dive into the decorator design pattern ([page 67](#)), our quiz ([page 78](#)), and our book review ([page 8](#)), as well as our calendar of upcoming developer conferences and events ([page 9](#)).













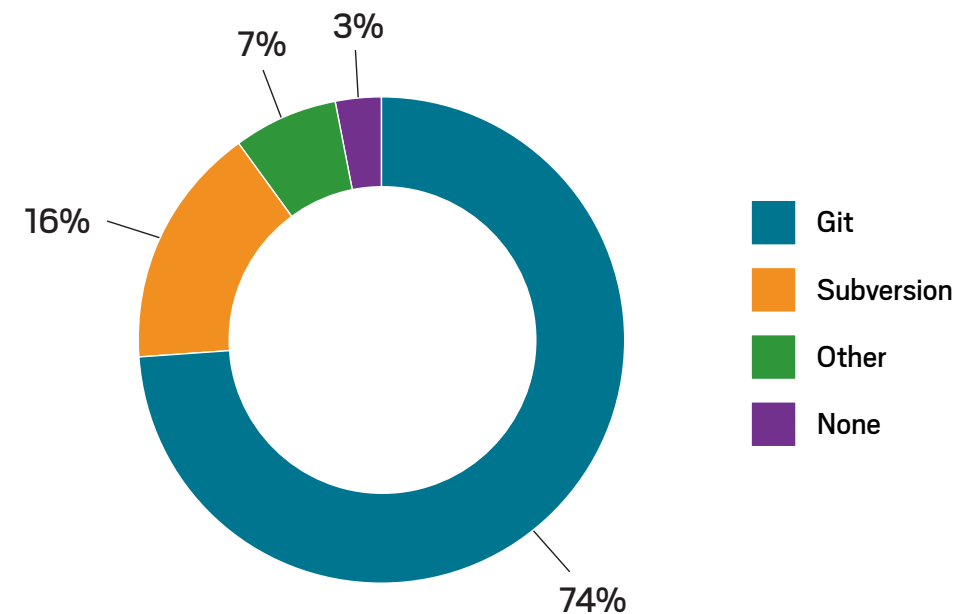






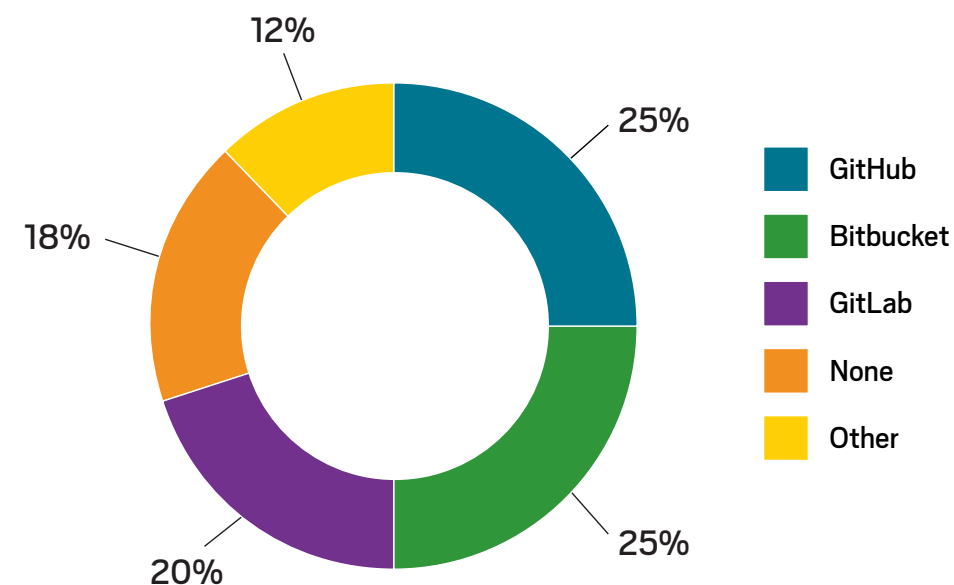


respondents; and somehow in 2018, 3% of people still don't use source code management whatsoever. Sometimes, there are no words.



## 11. Which code repository do you use for your main project?

With code repositories, the story is quite different from source code management: much more spread out, with GitHub and Bitbucket neck and neck at 25% each and GitLab close behind at 20%. We could call those the “big three” of project hosting. Note that this question is not just



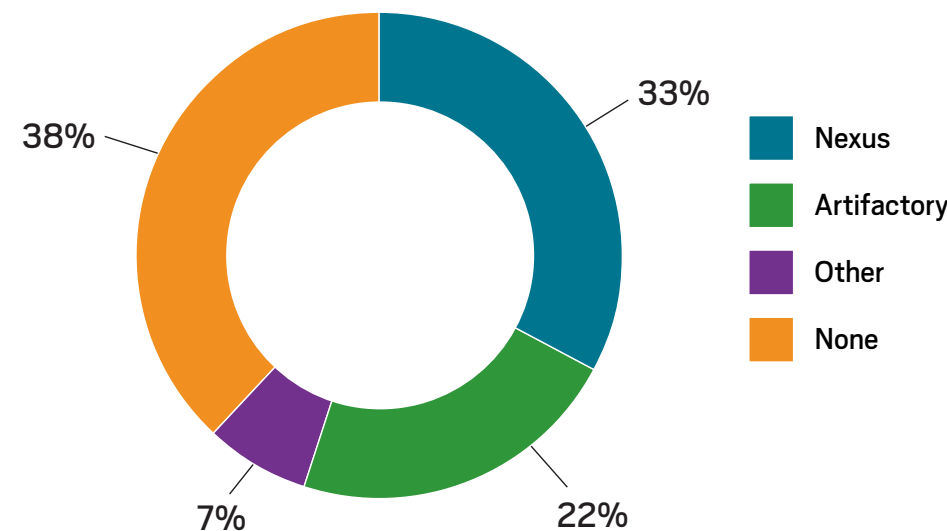


for public projects (in which we expect GitHub would have a more significant lead), but also for public and private project hosting.

Microsoft's recent acquisition of GitHub might affect its future adoption rate, and we'll know more in future surveys. Of the 25% share that GitHub has, just over half (52%) of those respondents are using the public version, whereas the remainder (48%) are using the private GitHub Enterprise on-premises offering. VSTS makes up part of the "Other" bucket with 2%.

## 12. Which private binary/artifact repository do you use?

Most sites don't use a packaged artifact repository—in theory because they don't have the need. Those that like the convenience it offers choose the well-established Nexus, which is heavily focused on the JVM ecosystem, followed by JFrog's Artifactory, which is somewhat more popular across polyglot ecosystems.



### 13. Which testing technologies do you use?

With an amazing (almost) 4 in 5 people using JUnit and TestNG used by 10% more, it's clear that unit testing is by far the most dominant testing practice in the JVM ecosystem. (Respondents







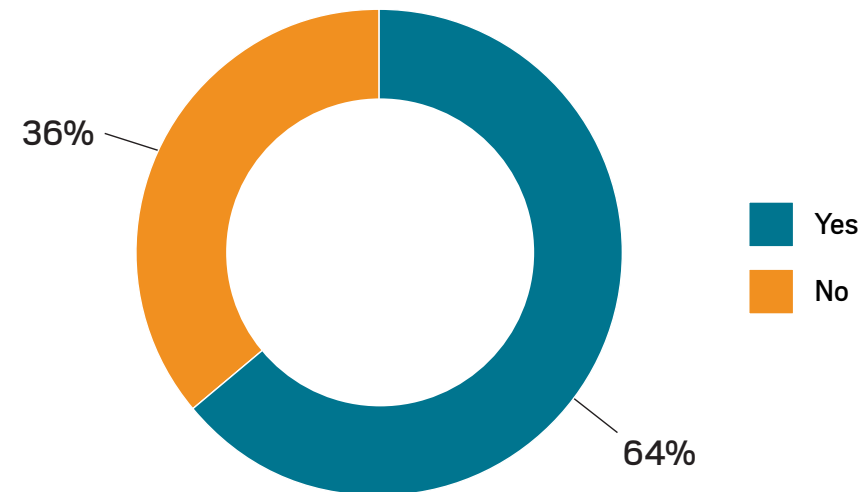




at 15%. In the larger enterprise app server category, Oracle WebLogic has a slight lead over WebSphere. The “Other” category contains Apache TomEE and Liberty Profile at 1% each, which lead that group.

## 21. Do you develop on the same application server you use in production?

Despite the obvious dangers, more than one-third of respondents develop on a different server from the one they use in production—trading the possible cost of failures for the convenience. Surprisingly, those who state they use different application servers (or none) in development actually have a wide variety of apps and servers in production. We were expecting mostly the larger monolith-suited app servers that could cause developers pain to use locally, but the ratios were comparable.



**22. How many open source (direct) dependencies does your main application have?**

It would be interesting to know how many people had to check to see how many direct dependencies their application has. We'd bet it was the vast majority of you. It's a good thing we didn't ask for direct and transitive dependencies too! In fact, almost 1 in 4 respondents openly state they don't know how many dependencies they have. This might be because of the way the application is distributed across a more complex build system. We can see from the results that fewer than 1 in 20 respondents don't use any open source dependencies, whereas the over-

















































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# ORACLE®



# Oracle JDK, Oracle OpenJDK, and the end of public updates for Java 8

## From the BCL to the GPL

## Functionally Identical and Interchangeable





features to the OpenJDK community, including Java Flight Recorder, Java Mission Control, application class-data sharing, and the Z garbage collector (ZGC).

From Java 11 forward, therefore, Oracle JDK builds and OpenJDK builds will be essentially identical. There do remain a small number of differences, some intentional and cosmetic, and some simply because more time for discussion with OpenJDK contributors is warranted.

## Differences Between Oracle JDK and OpenJDK

Oracle JDK 11 emits a warning when using the `-XX:+UnlockCommercialFeatures` option, whereas in OpenJDK builds this option results in an error. The `-XX:+UnlockCommercialFeatures` option was never part of OpenJDK, and it would not make sense to add it now because there are no commercial features in OpenJDK. This difference exists to make it easier for users of Oracle JDK 10 and earlier releases to migrate to Oracle JDK 11 and later.

Oracle JDK 11 can be configured to provide usage log data to the Advanced Management Console tool, which is a separate commercial Oracle product. Oracle will work with other OpenJDK contributors to discuss how such usage data might be useful in future releases of OpenJDK, if at all. This difference remains primarily to provide a consistent experience to Oracle customers until such decisions are made.

The `javac --release` command behaves differently for the Java 9 and Java 10 targets, because in those releases the Oracle JDK contained some additional modules that were not part of corresponding OpenJDK releases. The additional modules are

- `javafx.base`
- `javafx.controls`
- `javafx.fxml`
- `javafx.graphics`
- `javafx.media`
- `javafx.web`
- `java.jnlp`
- `jdk.jfr`
- `jdk.management.cmm`







Java HotSpot VM represents Java objects at runtime as *oops*, which is short for *ordinary object pointers*. Usually the oops that represent instances of a Java class are referred to as *instanceOops*. Java references are genuine pointers in the C sense and they point from the stack frame of the Java heap.

**For more than 20 years, the current memory layout pattern...** has had the advantage of simplicity, but there is a performance trade-off.

Specifically, all Java references point to the start of the *object header* of the object that they refer to. All Java objects are handled via an object reference, so all objects must have an object header. Unlike in C++, it is not possible to have a raw pointer to a type. There is simply no mechanism to handle objects without having the object header.

In Java HotSpot VM, the object header consists of two machine words, and the memory layout of every Java object starts with these two words. The *mark word* is the first of these, and it contains metadata that is specific to this precise instance. Following this is the *klass word*, which is a pointer to metadata that is class-specific. That means an object's *klass metadata* is shared with all other instances of the same class.

Both words of metadata are crucial to understanding how the Java runtime implements certain language features. For example, the `klass` word is used to look up the bytecode for Java methods.

However, for this discussion of value types, the mark word is especially important, because it is where Java objects store their identity. The mark word also stores the object's monitor (which is what allows threads to lock the object during synchronization).

To see the effect of Java's current simple model for values, let's take a closer look at the memory layout of arrays (which are, of course, objects in Java). In **Figure 1**, you can see an array

```
int[]  M  K  3  14  6  25
```

### Figure 1. Array of ints















and manually managing the different versions and dependencies. Starting with JavaFX 11, the JavaFX components are available in Maven Central and can be used with Maven and Gradle.

- **The JDK benefits from a smaller size and has a different release cadence.** The JDK itself is required by the typical build tools. Hence, Java developers still need to install a JDK. However, the lifecycle of the software they want to use does not necessarily match the lifecycle of the libraries they want to use. The fewer modules there are in the core JDK, the more flexibility developers have to decide which modules and components they want and what versions. It also makes the core JDK simpler and easier to maintain. Having modules that are not critical in the core JDK makes it harder to maintain the core: Modules that are in the core JDK require extreme caution to be maintained. JavaFX needs to be able to adapt to changes in the UI landscape and, therefore, benefits from its own release cycle and roadmap.
  - **End-user preference.** End users don't want to install Java runtimes on their systems anymore, nor do they want to upgrade them whenever there is a new release. They want applications that simply work. Applications should be self-contained and have all the dependencies they require—except for some libraries that are guaranteed to be available on the platforms. Requiring end users to download a JRE instance in order to run JavaFX applications would drastically lower the potential target audience. Instead, applications need to be self-contained, using tools like `jlink` and the Java Packager.
- JavaFX is still being developed in the OpenJFX project**, which is a subproject of the OpenJDK umbrella project.

**JavaFX is still being developed in the OpenJFX project**, which is a subproject of the OpenJDK umbrella project.

When these reasons were taken together, it was clear that the right path was to remove the JavaFX modules from the core JDK. Not everything changes, though. JavaFX is still being developed in the OpenJFX project, which is a subproject of the OpenJDK umbrella project. Therefore, OpenJFX follows the same procedures as the OpenJDK project, including different roles for participants—such as committers and reviewers—and it leverages the same project infrastructure. OpenJDK projects can have their own variations on the rules, so if the OpenJFX community decides to do so, it can make those procedures more specific and suitable for OpenJFX.







[developer.oracle.com/java](https://developer.oracle.com/java)  
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# #1 Developer Choice for the Cloud

*12 Million Developers Run Java*

*21 Billion Cloud-Connected Java Virtual Machines*

*38 Billion Java Virtual Machines are in the Cloud*

























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## Visitor Pattern

































